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IS 7778-5 (2003): Small Tools Sampling Inspection  
Procedures, Part 5: Milling Cutters [PGD 32: Cutting tools]

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भाग 5 मिलिंग कटर्स  
( पहला पुनरीक्षण )

*Indian Standard*

SMALL TOOLS SAMPLING INSPECTION  
PROCEDURES

**PART 5 MILLING CUTTERS**

*( First Revision )*

ICS 25.100.20

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BUREAU OF INDIAN STANDARDS  
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## FOREWORD

This Indian Standard (Part 5) (First Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Drills, Reamers and Threading Tools Sectional Committee had been approved by the Basic and Production Engineering Division Council.

This standard was first published in 1975. In the light of experience gained over the years, the following changes have been incorporated in this revision.

- a) Definition of various terminologies used in the standard have been aligned with the practice followed at ISO level.
- b) Scale of sampling and criteria of conformity have been modified.
- c) Classification of non-conformities for various type of cutting tools have been updated.
- d) To cater the specific need of the different industries and to make this standard user friendly, this standard has been splitted in 11 Parts for easy adoption/acceptance and guide updation.

This standard has been prepared based on prevalent practice and experience available in the Indian Industries. While formulating this standard considerable assistance has been derived from IS 2500 (Part 1) : 2000 'Sampling inspection procedures: Part 1 Attribute sampling plans indexed by acceptable quality level (AQL) for lot-by-lot inspection (*third revision*)'. IS 7778 'Small tools sampling inspection procedures' is now being published in 11 Parts. Other parts of the standard are given below:

- Part 1 Twist drills, countersinks and counterbores
- Part 2 Reamers
- Part 3 Sleeves, sockets and adaptors
- Part 4 Screwing taps, dies and knurling tools
- Part 6 Milling arbors and accessories
- Part 7 Gear cutting tools and broaches
- Part 8 Saws
- Part 9 Single point (HSS and carbide tipped) tools
- Part 10 Carbide tips and indexable inserts
- Part 11 Hard metal burrs

# Indian Standard

## SMALL TOOLS SAMPLING INSPECTION PROCEDURES

### PART 5 MILLING CUTTERS

#### *(First Revision)*

##### **1 SCOPE**

This standard (Part 5) specifies sampling plans and procedures for milling cutters submitted for inspection in lots.

##### **2 REFERENCES**

The following standards contain provisions which through reference in this text, constitute provision of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below:

<i>IS No.</i>	<i>Title</i>
2500 (Part 1) : 2000	Sampling inspection procedures : Part 1 Attribute sampling plans indexed by acceptable quality level (AQL) for lot-by-lot inspection ( <i>third revision</i> )
4905 : 1968	Methods for random sampling

##### **3 TERMINOLOGY AND DEFINITIONS**

For the purpose of this standard the following definitions shall apply. For terms not defined below and for other clarifications, reference may be made to IS 2500 (Part 1).

###### **3.1 Defect**

A departure of a quality characteristic that results in a product, process or service not satisfying its intended normal usage requirements.

###### **3.2 Non-Conformity**

A departure of a quality characteristic that results in a product, process or service not meeting a specified requirement. Non-conformities will generally be established by their degree of seriousness, such as:

Class A — Those non-conformities of a type considered to be of the highest concern for the product or service. In acceptance sampling, such types of non-conformity will be assigned very small AQL values.

Class B — Those non-conformities of a type considered to have the next lower degree of concern. Therefore these can be assigned a larger AQL value than those

in Class A and smaller than in Class C, if a third class exists.

###### **3.3 Non-Conforming Unit**

A unit of product or service containing at least one non-conformity. Non-conforming units will generally be classified by their degree of seriousness such as:

Class A — A unit which contains one or more non-conformities of Class A and may also contain non-conformities of Class B and/or Class C.

Class B — A unit which contains one or more non-conformities of Class B and may also contain non-conformities of Class C, but contains no non-conformity of Class A.

###### **3.4 Percent Non-Conforming**

The percent non-conforming of any given quantity of units of products is 100 times the number of non-conforming units divided by the total number of units of products, that is

Percent non-conforming

$$= \frac{\text{Number of non-conforming units}}{\text{Total number of units}} \times 100$$

###### **3.5 Acceptable Quality Level (AQL)**

When a continuous series of lots is considered, the quality level which for the purpose of sampling inspection is a limit of a satisfactory process average.

###### **3.6 Sampling Plan**

A specific plan which indicates the number of units of products from each lot which are to be inspected (sample size or series of sample sizes) and the associated criteria for determining the acceptability of the lot (acceptance and rejection numbers).

###### **3.7 Lot**

A collection of units of product from which a sample shall be drawn and inspected to determine conformance with the acceptability criteria, and which may differ from a collection of units designated as a lot for other purposes (for example, production, shipment, etc).

###### **3.8 Sample**

A sample consists of one or more units of product drawn from a lot, the units of the sample being selected

at random without regard to their quality. The number of units of product in the sample is the sample size.

#### 4 SCALE OF SAMPLING

**4.1** All small tools shall be selected at random from a lot as per IS 4905 to ensure randomness of selection.

**4.2** Small tools shall be selected and examined for each lot separately for ascertaining its conformity to the requirements of the relevant specification.

The number of small tools to be selected from a lot shall depend on the sizes of the lot and type of sampling plans and shall be in accordance with Tables 1, 2 and 3.

#### 5 DETERMINATION OF ACCEPTABILITY

**5.1** To determine acceptability of a lot under percent non-conforming inspection, the single sampling plan shall be used in accordance with **5.1.1** for hardness test and performance test and the double sampling plan shall be used in accordance with **5.1.2** for dimensional and visual characteristics.

##### 5.1.1 Single Sampling Plan

The number of sample units inspected shall be equal to the sample size given by the plan. If the number of non-conforming units found in the sample is equal to or less than the acceptance number, the lots shall be considered acceptable. If the number of non-conforming units is equal to or greater than the rejection number, the lot shall be considered not acceptable.

##### 5.1.2 Double Sampling Plan

The number of sample units first inspected shall be equal to the first sample size given by the plan. If the number of non-conforming units found in the first sample is equal to or less than the first acceptance number, the lot shall be considered acceptable. If the number of non-conforming units found in the first sample is equal to or greater than the first rejection number, the lot shall be considered not acceptable.

If the number of non-conforming units found in the first sample is between the first acceptance and rejection numbers, a second sample of the size given by the plan

**Table 1 Scale of Sampling and Criteria for Conformity for Lot Quality for Visual and Dimensional Characteristics (Double Sampling Plan for Normal Inspection — Inspection Level III)**  
(Clause 4.2)

Sl No.	Lot Size	Sample	Sample Size	Cumulative Sample Size	Non-Conformity			
					Class A AQL 1.5		Class B AQL 4.0	
					Ac	Re	Ac	Re
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
i)	Up to 150	First	20	20	0	2	1	4
		Second	20	40	1	2	4	5
ii)	151 to 280	First	32	32	0	3	2	5
		Second	32	64	3	4	6	7
iii)	281 to 500	First	50	50	1	4	3	7
		Second	50	100	4	5	8	9
iv)	501 to 1 200	First	80	80	2	5	5	9
		Second	80	160	6	7	12	13
v)	1 201 to 3 200	First	125	125	3	7	7	11
		Second	125	250	8	9	18	19

**Table 2 Scale of Sampling and Criteria for Conformity for Lot Quality for Hardness Test (Single Sampling Plan for Normal Inspections — Inspection Level I)**  
(Clause 4.2)

Sl No.	Lot Size	Sample Size	AQL 1.5	
			Ac	Re
(1)	(2)	(3)	(4)	(5)
i)	Up to 280	8	0	1
ii)	281 to 1 200	32	1	2
iii)	1 201 to 3 200	50	2	3

**Table 3 Scale of Sampling and Criteria for Conformity for Lot Quality for Performance Test (Single Sampling Plan for Reduced Inspections — Inspection Level S-3)**  
(Clause 4.2)

Sl No.	Lot Size	Sample Size	AQL 4.0	
			Ac	Re
(1)	(2)	(3)	(4)	(5)
i)	Up to 150	2	0	1
ii)	151 to 3 200	5	0	2

shall be inspected. The number of non-conforming units found in the first and second samples shall be accumulated. If the cumulative number of non-conforming units is equal to or less than the second acceptance number, the lot shall be considered acceptable. If the cumulative number of non-conforming units is

equal to or greater than the second rejection number the lot shall be considered not acceptable.

## 6 CLASSIFICATION OF NON-CONFORMITY

**6.1 Non-conformities of various inspection parameters for milling cutters covered under various Indian**

**Table 4 Classification of Non-Conformity in Milling Cutters**  
(*Clause 6.1*)

Sl No.	IS No.	Type of Tool	Class A Non-Conformity	Class B Non-Conformity
(1)	(2)	(3)	(4)	(5)
i)	2668	T-slot milling cutters	Hardness, Cutting edge diameter, Cutting edge width, Shank diameter and Morse taper shank	Overall length, Neck diameter, Neck length and Chamfer
ii)	2669	Woodruff key slot milling cutters	Hardness, Cutting edge diameter, Cutting edge width and Shank diameter	Overall length, Neck diameter, Shank length and Corner radius
iii)	2670	Thread milling cutters-shell type	Hardness, Cutter diameter, Bore diameter, Length and Keyway	Counterbore diameter and Counterbore length
iv)	2671	Interlocked milling cutters	Hardness, Cutter diameter, Width, Bore diameter and Keyway	Boss diameter and Possible adjustment
v)	5698	Rotary form relieved gear cutter for spur and helical gear	Cutter diameter, Bore diameter, Hardness, Profile form and Keyway	Cutter width
vi)	6255	Dovetail milling cutters	Hardness, Cutter diameter, Shank diameter and Angle (included)	Cutter width, Overall length and Neck diameter
vii)	6256	Shell end single angle milling cutter	Hardness, Cutter diameter, Bore diameter, Keyway Included angle	Cutter width, Dimension $b_1$ and Diameter $d_1$ and $d_2$
viii)	6257	Shell end mills	Hardness, Cutter diameter and Bore diameter	Cutter width, Dimension $l$ and Driving slot width and depth
ix)	6308	Side and face milling cutter	Hardness, Cutter diameter, Bore diameter, Width and Keyway	
x)	6309	Cylindrical milling cutters	Hardness, Cutter diameter, Bore diameter and Keyway	Cutter length
xi)	6314	Single corner rounding milling cutters	Hardness, Cutter diameter, Bore diameter, Radius and Keyway	Cutter width
xii)	6322	Concave milling cutters	Hardness, Cutter diameter, Bore diameter, Radius and Keyway	Cutter width
xiii)	6323	Convex milling cutters	Hardness, Cutter diameter, Bore diameter, Radius and Keyway	Cutter width
xiv)	6324	Single angle milling cutters	Hardness, Cutter diameter, Bore diameter, Angle and Keyway	Cutter width
xv)	6325	Double angle milling cutters	Hardness, Cutter diameter, Bore diameter, Angle and Keyway	Cutter width
xvi)	6326	Equal angle milling cutters	Hardness, Cutter diameter, Bore diameter, Angle and Keyway	Cutter width
xvii)	6352	Slot drills with parallel shank	Hardness, Cutter diameter and Shank diameter	Cutter edge length, Overall length and Shank length
xviii)	6353	End mills with parallel shank	Hardness, Cutter diameter and Shank diameter	Cutter edge length, Overall length and Shank length
xix)	6354	End mills with morse taper tapped end shank	Hardness, Cutter diameter and Morse taper shank	Cutter edge length and Overall length
xx)	6355	Keyway milling cutter	Hardness, Cutter diameter, Bore diameter, Width and Keyway	
xxi)	6388	Slot drills with morse taper shanks	Hardness, Cutter diameter and Morse taper shank	Cutter edge length and Overall length
xxii)	6550	Thread milling cutters with parallel shanks	Hardness, Cutter diameter and Shank diameter	Cutter edge length, Overall length and Shank length
xxiii)	6551	Thread milling cutters with morse taper shank	Hardness, Cutter diameter and Morse taper shank	Cutter edge length and Overall length
xxiv)	10255	Tapered die sinking cutters with parallel shanks	Hardness, Smaller dia/ Ball nose dia and Shank diameter	Cutter edge length, Overall length and Taper angle
xxv)	10465	Chain wheel rotary tooth form milling cutter	Hardness, Cutter diameter, Bore diameter, Profile form and Keyway	Cutter width

Standards have been classified as Class A and Class B and are tabulated in Table 4.

**6.2** Non-conformity of various inspection parameters for carbide tipped milling cutters covered under various Indian Standards have been classified as class

A and Class B and are tabulated in Table 5.

**6.3** Non-conformities of various inspection parameters for milling cutters with indexable inserts covered under various Indian Standards have been classified as Class A and Class B and are tabulated in Table 6.

**Table 5 Classification of Non-Conformity in Carbide Tipped Milling Cutters**

(Clause 6.2)

Sl No.	IS No.	Type of Tool	Class A Non-Conformity	Class B Non-Conformity
(1)	(2)	(3)	(4)	(5)
i)	9323	Carbide tipped end mills with parallel shank	Hardness on shank, End mill diameter and Shank diameter	Cutting edge length, Shank length and Overall length
ii)	9324	Carbide tipped end mills with morse taper shank	Hardness on shank, End mill diameter and Morse taper shank	Cutting edge length and Overall length
iii)	9325	Carbide tipped slot milling cutters with parallel shank	Hardness on shank, Slot drill diameter and Shank diameter	Cutting edge length, Shank length and Overall length
iv)	9326	Carbide tipped slot milling cutters with morse taper and tapped end shank	Hardness on shank, Slot drill diameter and Morse taper shank	Cutting edge length and Overall length

**Table 6 Classification of Non-Conformity in Milling Cutters with Indexable Inserts**

(Clause 6.3)

Sl No.	IS No.	Type of Tool	Class A Non-Conformity	Class B Non-Conformity
(1)	(2)	(3)	(4)	(5)
i)	12716 (Part 1)	End mills with indexable inserts with flattened parallel shanks	Cutting edge diameter and Shank diameter	$l_1$ length, Overall length, Shank length and Flat dimensions
ii)	12716 (Part 2)	End mills with indexable inserts with morse taper shanks	Cutting edge diameter and Morse taper shank	$l_1$ length and Overall length
iii)	13167	Side and face milling cutters with indexable inserts	Outside diameter, Bore diameter, Cutter width and Keyway	Boss diameter and Boss width
iv)	13244	Half side and face cutters with indexable inserts	Outside diameter, Bore diameter, Cutter width and Keyway	Boss diameter and Boss width

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